INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB2004/002980

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G01T1/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G01T

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 02/063339 A (CARIA MARIO RAIMONDO ; SMITH KENWAY MONTGOMERY (GB); UNIV GLASGOW (GB)) 15 August 2002 (2002-08-15) the whole document	9-19,23, 24,26, 31-33
Y		21,22
A		1-8,25, 27-30

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 January 2005	27. 01. 2005

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Coda, R

Form PCT/ISA/210 (second sheet) (January 2004)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	SCHWARZ C ET AL: "Measurements with Si and GaAs pixel detectors bonded to photon counting readout chips" NUCLEAR INSTRUMENTS & METHODS IN PHYSICS RESEARCH, SECTION - A: ACCELERATORS, SPECTROMETERS, DETECTORS AND ASSOCIATED EQUIPMENT, NORTH-HOLLAND PUBLISHING COMPANY. AMSTERDAM, NL, vol. 466, no. 1, 21 June 2001 (2001-06-21), pages 87-94, XP004251280 ISSN: 0168-9002 page 87, paragraph 1 - page 88, paragraph 3	9,10, 13-16, 18-20, 23,24, 26,31
A		1-8,25, 27-30
X	US 5 812 191 A (SARAKINOS MILTIADIS EVANGELOS ET AL) 22 September 1998 (1998-09-22) column 2, line 27 - column 6, line 19 column 11, line 15 - column 12, line 26 column 14, line 35 - column 15, line 17 figures 1,2,8,10	23
Y		21,22
A	EISEN Y: "Current state-of-the-art industrial and research applications using room-temperature CdTe and CdZnTe solid state detectors" NUCLEAR INSTRUMENTS & METHODS IN PHYSICS RESEARCH, SECTION - A: ACCELERATORS, SPECTROMETERS, DETECTORS AND ASSOCIATED EQUIPMENT, NORTH-HOLLAND PUBLISHING COMPANY. AMSTERDAM, NL, vol. 380, no. 1-2, 1 October 1996 (1996-10-01), pages 431-439, XP004206359 ISSN: 0168-9002 the whole document	1-8, 27-33
X	US 2003/069002 A1 (HUNTER CHARLES ERIC ET AL) 10 April 2003 (2003-04-10) the whole document	34-52
X	US 5 986 276 A (LABRIOLA II DONALD P) 16 November 1999 (1999-11-16) column 2, line 66 - column 3, line 5 column 4, line 27 - column 5, line 67	34-36, 46,47

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 100 806 A (GAUKEL JOHN J) 8 August 2000 (2000-08-08) column 5, line 56 - column 6, line 47 column 7, line 20 - column 9, line 32 column 11, line 13 - column 14, line 59 column 19, line 59 - column 20, line 44	34, 37-42, 44,45

Form PCT/ISA/210 (continuation of second sheet) (January 2004)

INTERNATIONAL SEARCH REPORT

.tional application No.
PCT/GB2004/002980

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

As a result of the prior review under R. 40.2(e) PCT,
no additional fees are to be refunded.

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☒ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-33

An assembly and a method for monitoring ionising radiation having: a detector substrate for generating electronic charge in response to incident ionising radiation, the detector having an array of sense volumes; a circuit substrate supporting readout circuits corresponding to the sense volumes, each circuit being switchable between two charge integration modes, the first one arranged to sense a single ionising radiation event and the second one arranged to sense a plurality of ionising radiation events. Moreover the circuits have a photon counting circuitry responsive to events having first and second energy range.

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2. claims: 34-52

A system and a method for remote monitoring of ionising radiation having at least one monitoring device including a communication unit for communicating teh radiation data over a communication network and a control station to receive this radiation data. A possible hazardous radiation is detected by analysing the radiation spectroscopic data.

INTERNATIONAL SEARCH REPORT

International Application No
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 02063339 A	15-08-2002	EP 1358509 A1	05-11-2003
		WO 02063339 A1	15-08-2002
		JP 2004530864 T	07-10-2004
		US 2004096031 A1	20-05-2004
US 5812191 A	22-09-1998	GB 2289979 A	06-12-1995
		GB 2289981 A	06-12-1995
		GB 2289983 A ,B	06-12-1995
		AT 172343 T	15-10-1998
		AU 691926 B2	28-05-1998
		AU 2672095 A	21-12-1995
		CA 2191100 A1	07-12-1995
		CN 1155955 A ,B	30-07-1997
		DE 69505375 D1	19-11-1998
		DE 69505375 T2	08-04-1999
		DK 763302 T3	23-06-1999
		WO 9533332 A2	07-12-1995
		EP 0763302 A2	19-03-1997
		EP 0854643 A2	22-07-1998
		EP 0854644 A2	22-07-1998
		EP 0853427 A2	15-07-1998
		EP 0854639 A2	22-07-1998
		ES 2123991 T3	16-01-1999
		FI 964728 A	02-12-1996
		GB 2289980 A	06-12-1995
		HK 1014819 A1	18-08-2000
		IL 113921 A	15-04-1997
		JP 10505469 T	26-05-1998
		NO 965104 A	03-02-1997
		NZ 287868 A	24-04-1997
		US 2003164888 A1	04-09-2003
		US 6035013 A	07-03-2000
		US 2001002844 A1	07-06-2001
		US 2002089595 A1	11-07-2002
US 2003069002 A1	10-04-2003	NONE	
US 5986276 A	16-11-1999	NONE	
US 6100806 A	08-08-2000	US 6072396 A	06-06-2000
		WO 03060549 A1	24-07-2003
		US 6337665 B1	08-01-2002

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 28185-502-061	**FOR FURTHER ACTION**	See Form PCT/IPEA/416
International application No. PCT/GB2004/002980	International filing date *(day/month/year)* 09.07.2004	Priority date *(day/month/year)* 12.07.2003
International Patent Classification (IPC) or national classification and IPC G01T1/24		
Applicant RADIATION WATCH LIMITED et al.		

1. This report is the International preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 8 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 12 sheets, as follows:
      ☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the opinion
☐	Box No. II	Priority
☒	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
05.05.2005	30.08.2005
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Coda, R Telephone No. +49 89 2399-2802

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/GB2004/002980

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3 and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4)
   - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

   Description, Pages

   1-41 as originally filed

   Claims, Numbers

   1-52 as originally filed

   Drawings, Sheets

   1/16-16/16 as originally filed

   ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application,

☒ claims Nos. 31, 32, 50, 51

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (specify):

☒ the description, claims or drawings *(indicate particular elements below)* or said claims Nos. 31, 32, 50. 51 are so unclear that no meaningful opinion could be formed *(specify)*:

see separate sheet

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☐ no international search report has been established for the said claims Nos.

☐ the nucleotide and/or amino acid sequence listing does not comply with the standard provided for in Annex C of the Administrative Instructions in that:

the written form	☐	has not been furnished
	☐	does not comply with the standard
the computer readable form	☐	has not been furnished
	☐	does not comply with the standard

☐ the tables related to the nucleotide and/or amino acid sequence listing, if in computer readable form only, do not comply with the technical requirements provided for in Annex C-*bis* of the Administrative Instructions.

☐ See separate sheet for further details

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1 to 8, 11, 12, 20 to 30, 33 to 49
	No:	Claims	9, 10, 13 to 19
Inventive step (IS)	Yes:	Claims	1 to 8, 23 to 30, 33 to 49
	No:	Claims	11, 12, 20 to 22
Industrial applicability (IA)	Yes:	Claims	1-51
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. The subject-matter of claims 9, 10, 13 to 19 is not new (Art. 33(2) PCT).

1.1 As far as the first and second radiation sense volumes are concerned, it is noted that the figure 7 of the application illustrates different areas (1 to 4) linked to different parts of the spectrum. These areas are characterised by individual threshold counting circuits, This configuration is exactly disclosed in the document D1 (WO02/063339 A1). Figure 3B shows a semiconductor pixel detector comprising a plurality of tiled wafer chips 20, each chip having a plurality of pixels with individual photon counters (see page 11, lines 5 to 10). When a pixel absorbs a photon, an electrical signal is generated and readout by the circuit illustrated in figure 5B. In order to obtain accurate images representative of the irradiated subject several latched comparators 64 can be connected in parallel, each with a different threshold level. This would allow a number of absorbed x-rays in each of a range of energy intervals to be simultaneously recorded and considered in determining by image processing the most suitable energy range for providing the most useful image of the subject being irradiated (see page 14, lines 4 to 12). Therefore D1 discloses the possibility of building-up detecting areas responsive to different energy ranges.

1.2 Therefore, with respect to independent claims 9 and 10, the D1 discloses an assembly for monitoring ionising radiation having: a detector substrate for generating electronic charge in response to incident ionising radiation, the detector having an array of sense volumes; a circuit substrate supporting readout circuits corresponding to first and second sense volumes (see page 10, lines 18; page 10, line 24 to page 11, line 10; page 11, lines 25 to 27; page 12, lines 9 to 14; figure 4(23)), wherein each readout circuit includes a photon counting circuitry responsive to events having first and second energy range and able to increment first and second counter respectively (see page 13, line 18 to page 14, line 12). The subject-matter of amended claim 9 and original claim 10 is then not new.

1.3 The dependent claims 13 to 19 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty. The threshold circuitry and the semiconductors are disclosed by the documents D1 (see page 10, lines 24 to 28; page 11, lines 21 to 28; page 12, lines 1 to 6; page 13, lines 19 to 28; page 14, lines 1 to 12; page 16, lines 7 to 20; page 17, line 27 to page 18, line 1). Moreover D1 discloses also the bias signal (see page 12, lines 5, 6).

2. The dependent claims 11, 12 and 20 to 22 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step (Article 33(3) PCT):
   - claims 11, 12: the use of several detection period is a normal design procedure for the skilled person in order to improve the system reliability ;
   - claims 20 to 22: the use of CMOS (see D2 - XP4251280 - page 87, paragraph 1, right column, line 2) and of the measurements selection is merely one of several straightforward possibilities from which the skilled person would select, without the exercise of inventive skill, in order to improve the system flexibility (see D3 - US5812191, column 21, lines 1 to 5).

3. Although claims 1, 9, 10, 24 and 26 have been drafted as separate independent claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought and in respect of the terminology used for the features of that subject-matter. The aforementioned claims therefore lack conciseness. Moreover, lack of clarity of the claims as a whole arises, since the plurality of independent claims makes it difficult, if not impossible, to determine the matter for which protection is sought, and places an undue burden on others seeking to establish the extent of the protection. Hence, claims 1, 9, 10, 23 and 27 do not meet the requirements of Article 6 PCT.

4. Contrary to the requirements of Rule 6.2(a) PCT, claims 31, 32, 50 and 51 rely on reference to the drawings.

5. As far as claims 1 to 8, 23 to 30 and 33 to 49 are concerned, the following is noted:

5.1 Technical Field

Monitoring of ionising radiation.

5.2 Novelty (Art. 33(2) PCT)

None of the cited documents discloses readout circuits being switchable between two charge integration modes, the first one arranged to sense a single ionising radiation event and the second one arranged to sense a plurality of ionising radiation events. Therefore the subject-matter of claims 1, 24 and 26 is novel (Article 33(2) PCT).

5.3 Inventive Step (Art. 33(3) PCT)

Document D1 represents the closest prior art.

This document discloses an assembly for monitoring ionising radiation having: a detector substrate for generating electronic charge in response to incident ionising radiation, the detector having an array of sense volumes; a circuit substrate supporting readout circuits corresponding to the sense volumes.

Claims 1 and 24 are distinguished in that each readout circuit is switchable between two charge integration modes, the first one arranged to sense a single ionising radiation event and the second one arranged to sense a plurality of ionising radiation events.

The problem to be solved by the present invention may therefore be regarded as how to provide a device for monitoring ionising radiation with enhanced monitoring, evaluation and analysis capabilities.

Since none of the cited documents hints at including a switch to select a charge integration mode, causing the advantage of improving the assembly monitoring, evaluation and analysis capabilities, claims 1 and 24 meet therefore the requirements of inventive step referred to in Art. 33(3) PCT.

It is noted that the independent method claim 26 corresponds to the independent apparatus claim 1 in that for every structural feature of claim 1 a corresponding method step is defined therein. Therefore also the independent claim 26 meets the requirements of inventive step referred to in Art. 33(3) PCT.

5.4 Industrial Applicability

Without any doubts the application as defined in claims 1 to 8, 23 to 30 and 33 to 49 is industrially applicable.

5.5 Dependent Claims

Claims 2 to 8, 23, 25, 27 to 30 and 33 to 49 are dependent on claims 1, 24 and 26 respectively and as such also meet the requirements of the PCT with respect to novelty and inventive step.